

**Little Sandy Creek Source Identification
Water Quality Study
2001**



**SURVEYS SECTION
ASSESSMENT BRANCH
OFFICE OF WATER QUALITY
INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
IDEM 032/02/073/2003**

**Little Sandy Creek Source Identification
Water Quality Study
2001**

By

Timothy Beckman, Environmental Manager

Compilation and development of the final report was the primary responsibility of the Surveys Section
Arthur C. Garceau, Section Chief

Surveys Section
Assessment Branch
Office of Water Quality
Indiana Department of Environmental Management
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Cover Photo - Little Sandy Creek at CR 700 E (Site OLP090-0008), facing upstream

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Abstract

Little Sandy Creek is situated in the Ohio River Basin and drains predominately agricultural land in southern Spencer County. The presence of scattered strip mine areas in the northern portion of this small watershed have a negative impact on the water quality of Little Sandy Creek. Samples collected on Little Sandy Creek during the 2000 Probabilistic Survey revealed stream standard violations for Dissolved Oxygen, Sulfate, and Total Dissolved Solids. In addition, the results of the 2000 biological survey indicated a very poor fish community and only marginal habitat conditions. A follow-up Source ID study was conducted during the summer of 2001 to determine the extent of and identify the sources causing the impaired conditions. Findings of the Source ID study indicate that elevated Sulfate and Total Dissolved Solids continue to be a problem in Little Sandy Creek. The likely cause of the Sulfate and Total Dissolved Solids impairment is from runoff of strip mine areas. Dissolved Oxygen impairments were also found in Little Sandy Creek during the 2001 Source ID study. A field datalogger was programmed and deployed in Little Sandy Creek for the collection of unattended field data readings. This datalogger revealed low Dissolved Oxygen concentrations throughout the 22-hour logging period. The source or sources of the depressed Dissolved Oxygen concentrations are not certain, but seem to be related to a very low stream gradient and very low stream flows. Significant amounts of detritus and a deep muck substrate only serve to further suppress the Dissolved Oxygen concentrations in Little Sandy Creek.

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Introduction

Little Sandy Creek is located in southern Spencer County and is situated in the Ohio River Basin. Little Sandy Creek Watershed has a total drainage area of 11.9 square miles (Hoggatt 1975) and an approximate stream gradient of 5.8 feet per mile. Land use in this small watershed is predominately agricultural represented by row crop and pasture, but a few strip-mined areas are present in the upper reaches. Little Sandy Creek was sampled as part of the Watershed Monitoring Program for the Ohio River Basin in 2000 in support of the *Surface Water Quality Monitoring Strategy 1996-2000* (IDEM 1998). A probabilistically selected site on Little Sandy Creek was sampled three times in the spring and summer of 2000 for water chemistry and one time for a biological assessment. Water chemistry results revealed dissolved oxygen concentrations below the minimum state stream standard of 4.0 mg/L¹ during two of the three sampling events in Little Sandy Creek at site OLP090-0001. This site was located approximately 0.2 miles downstream of County Road 700 East. Additionally, sample analysis indicated that sulfate and total dissolved solids concentrations were above the state stream standard of 250 mg/L and 750 mg/L respectively², at the same sample site. Sulfate exceeded the standard during two of the three sampling events and total dissolved solids exceeded the standard on one occasion.

A biological assessment survey was conducted in conjunction with the second water chemistry sampling effort on 7/11/2000. A very low score was measured for the Index of Biological Integrity (IBI) (Simon DRAFT). The measured value of 14 is below the aquatic life use support criteria index of 32 for streams in the Ohio River Basin (IDEM 2002a). In addition, the Qualitative Habitat Evaluation Index (QHEI) (IDEM 1992), was scored at 50, a level classified as "not supportive" of aquatic life for streams in the Ohio River Basin (IDEM 2002a).

Methods and Materials

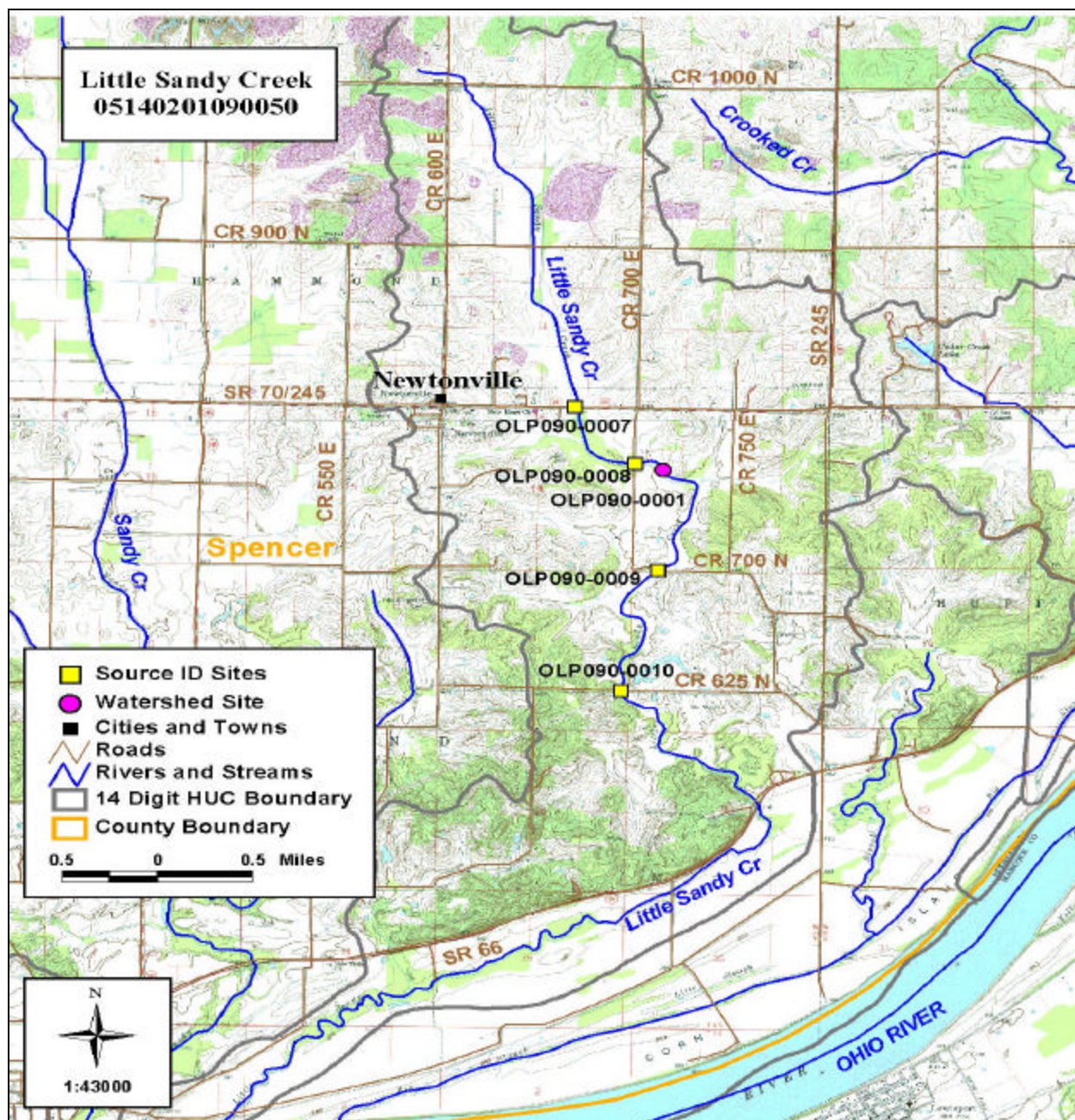
On September 18-19, 2001, a water quality sampling survey was conducted on Little Sandy Creek. Two sites were situated upstream and two downstream of the original 2000 sample site OLP090-0001, as shown in Figure 1. Grab samples were collected at four targeted sites for general chemistry, nutrient, and metal parameters. Additionally, all sites were sampled for field data parameters using a Hydrolab multi-parameter instrument (Hydrolab 1995). All samples were collected in accordance with the *Surveys Section Field Procedure Manual* (IDEM 2002b). Site locations were determined by upstream and downstream proximity to the original 2000 Watershed site and accessibility as provided by local roads and bridges. The original sampling plan called for the collection of 2 part composites at all sampling sites, but due to the threat of rain, only grab samples were collected. Detailed sample location descriptions are listed in Table 1.

Table 1 Site Location Descriptions

Site ID	Stream	Location	Latitude/Longitude
OLP090-0007	Little Sandy Cr	SR 70/245	38° 00' 43" /86° 55' 29"
OLP090-0008	Little Sandy Cr	CR 700 E	37° 59' 46" / 86° 55' 29"
OLP090-0009	Little Sandy Cr	CR 700 N	37° 59' 11" /86° 55' 21"
OLP090-0010	Little Sandy Cr	CR 625 N	37° 58' 31" /86° 55' 34"

¹ 327 IAC 2-1-6(b) (IDEM 2000)

² 327 IAC 2-1-6(a) (IDEM 2000)

Figure 1 Map of Little Sandy Source ID Study Area

Additionally, one YSI 6920 multiparameter datalogger was deployed and programmed to record the field data parameters of temperature, dissolved oxygen, pH, and specific conductance, every 15 minutes from 11:30 AM on 9/18/01 to 9:30 AM on 9/19/01. The datalogger was placed in Little Sandy Creek approximately 0.1 miles upstream of CR 700 East. Field and laboratory parameters collected for this study are presented in Tables 2 and 3.

Table 2 Field Parameters Collected for Little Sandy Source ID Study

Parameter	Method	Accuracy
Dissolved Oxygen	SM 4500-OG	+/- 0.2 mg/L
Turbidity	SM 2130 ⁽¹⁾	+/- 5% of range
Specific Conductance	SM 2510	+/- 1% of range
Temperature	SM 2550	+/- 0.15° Celsius
pH	SM 4500-H	+/- 0.2 SU

⁽¹⁾Or SM 2130 modified method utilizing a light emitting diode sensor

Table 3 Chemical Parameters Analyzed for Little Sandy Source ID Study

Anions/Physical			Nutrients/Organic		
Parameter	Method	MRL⁽¹⁾	Parameter	Method	MRL
Alkalinity	310.1	10 mg/L	TKN	351.2	0.10 mg/L
CBOD ₅	405.1	5.0 mg/L	Ammonia -N	350.1	0.10 mg/L
Total Solids	160.3	7.0 mg/L	Nitrate+Nitrite-N	353.2	0.01 mg/L
Suspended Solids	160.2	4.0 mg/L	Total Phosphorus	356.2	0.03 mg/L
Dissolved Solids	160.1	10 mg/L	TOC	415.1	1.0 mg/L
Sulfate	375.2	5.0 mg/L	COD	410.4	5.0 mg/L
Chloride	325.2	1.0 mg/L			
Hardness	130.1	1.0 mg/L			

Metals					
Parameter	Method	MRL	Parameter	Method	MRL
Aluminum	200.8	100 ?g/L	Magnesium	200.7	1000 ?g/L
Antimony	200.8	1 ?g/L	Manganese	200.8	10 ?g/L
Arsenic	200.8	5 ?g/L	Mercury	245.1	0.2 ?g/L
Barium	200.8	20 ?g/L	Nickel	200.8	2 ?g/L
Beryllium	200.8	1 ?g/L	Potassium	200.7	1000 ?g/L
Cadmium	200.8	1 ?g/L	Selenium	200.8	5 ?g/L
Calcium	200.7	1000 ?g/L	Silver	200.8	1 ?g/L
Chromium	200.8	2 ?g/L	Sodium	200.7	1000 ?g/L
Hex. Chromium	SM3500Cr-D	0.01 ?g/L	Thallium	200.8	1 ?g/L
Cobalt	200.8	10 ?g/L	Vanadium	200.7	50 ?g/L
Copper	200.8	3 ?g/L	Zinc	200.8	10 ?g/L
Lead	200.8	2 ?g/L			

⁽¹⁾Method Reporting Limit

Quality Assurance

Contracting laboratories provide analytical reports to IDEM that contain test results and Quality Control information for each batch of samples delivered to them. Quality assurance and quality control (QA/QC) procedures for this study adhered to the Quality Assurance Project Plan (QAPP) and all field and laboratory data collected for this study met QA/QC requirements for Indiana Surface Water Quality Monitoring Programs of the Assessment Branch (IDEM 1999). See Attachment II for a complete copy of the Quality Assurance Report. Generally, the QAPP requires one duplicate and one matrix spike/matrix spike duplicate (MS/MSD) for every ten samples collected in addition to one blank sample for every field trip. This study only required four stream samples so that one duplicate, one MS/MSD, and one blank adequately satisfied

QA/QC requirements. Stream samples and field data are also required to meet Data Quality Assessment levels cited in the QAPP for Indiana Surface Water Quality Programs.

Results and Discussion

Field and Laboratory Data

Field data and laboratory analysis results, presented in Tables 4 and 5, reveal elevated levels of total dissolved solids and sulfate. Three sampling sites exceeded the state stream standard of 250 mg/L for sulfate, and two exceeded the standard of 750 mg/L for total dissolved solids. Runoff from coal mine areas located in the upper reaches of this watershed, indicated by the purple areas in Figure 1, is the likely source of these high concentrations. Acid mine waters are formed when water and air oxidize exposed coal pyrite to form sulfuric acid. The resulting runoff can contribute to elevated concentrations of sulfate, metals, and total dissolved solids to the surrounding surface waters (Csuros 1994).

Dissolved Oxygen

The dissolved oxygen concentrations recorded from Little Sandy Creek at all the bridge sampling locations did not fall below the daily minimum standard of 4 mg/L (Table 4). However, the dissolved oxygen concentrations recorded by a datalogger placed upstream of site OLP090-0008 revealed very low dissolved oxygen concentrations (Table 6 and Figure 2). The discrepancy between the bridge sample dissolved oxygen readings and those recorded by the datalogger may be the result of the placement of the datalogger in the stream. The datalogger was located in an extremely shaded area of the stream that was very shallow and had very low stream flow velocities (cover photo). The average dissolved oxygen reading as recorded by the datalogger was 1.99 mg/L for the deployment period between 11:30 AM on 9/18/01 and 9:30 AM on 9/19/01. It should be noted that there is not a significant diurnal fluctuation of dissolved oxygen represented in these results. The difference between the low dissolved oxygen concentrations recorded by the datalogger and the relatively higher concentrations recorded at the bridges may be due in part to the lack of shading and presence of duck weed and rooted aquatic macrophytes at the bridge sites. The vegetation likely contributed some additional dissolved oxygen to the stream at these locations. The open canopy and abundant plant growth were only noted along relatively small areas of the stream near the bridge sampling locations and were not representative of the overall stream characteristic of Little Sandy Creek between sample sites OLP090-0007 and OLP090-0009 (Figures 3, 4, and 5).

Table 4 Field Data Results for the 2001 Little Sandy Creek Water Quality Study

Site	Date	Time	Dissolved Oxygen mg/L	pH SU	Temp. °C	Spec. Con. ? S/cm	Turbidity NTU
OLP090-0007	9/18/01	12:55 PM	4.95	7.94	20.24	1353	22.6
OLP090-0008	9/18/01	1:25 PM	6.07	7.88	20.21	1168	8.4
OLP090-0008	9/19/01	9:35 AM	4.63	7.89	19.12	1291	9.0
OLP090-0009	9/18/01	2:05 PM	8.06	7.92	21.33	1450	16.9
OLP090-0010	9/18/01	2:40 PM	5.52	7.33	20.4	876	19.1

Table 5 Laboratory Results for the 2001 Little Sandy Creek Water Quality Study

Parameter	Sampling Sites			
	OLP090-0007	OLP090-0008	OLP090-0009	OLP090-0010
Alkalinity - mg/L	430	340	370	230
Biochemical Oxygen Demand, Carbonaceous 5-day - mg/L	2.7 (DJ) ⁽¹⁾	< 2 (DJ)	2.2 (DJ)	2.3 (DJ)
Chloride - mg/L	17	36	41	16
Chromium, Hexavalent - mg/L	<0.010 (QHJ)	<0.010 (QHJ)	<0.010 (QHJ)	<0.010 (QHJ)
Chemical Oxygen Demand - mg/L	<5.0	8.3	<5.0	8
Hardness (as CaCO3) Calculated - mg/L	327	320	571	334
Nitrogen, Ammonia - mg/L	<0.10	<0.10	<0.10	<0.10
Nitrogen (Total) Kjeldahl - mg/L	0.87	0.82	0.64	1.0
Nitrogen, Nitrate+Nitrite - mg/L	0.034	0.052	0.034	0.15
Phosphorus, Total - mg/L	0.21	0.18	0.087	0.12
Solids, Total Dissolved - mg/L	850	720	980	540
Solids, Total Suspended - mg/L	68	4	8	13
Solids, Total - mg/L	930	730	1100	560
Sulfate - mg/L	270 (DJ)	230 (DJ)	420 (DJ)	320 (DJ)
Total Organic Carbon - mg/L	4.7	7.8	6.2	8.4
Aluminum (Total) - ug/L	779	125	371	293
Barium (Total) - ug/L	62	56	61	59
Calcium - ug/L	59800	61100	129000	79200
Chromium (Total) - ug/L	<2.0	<2.0	<2.0	<2.0
Lead (Total) - ug/L	<2.0	<2.0	<2.0	<2.0
Magnesium - ug/L	43200	40600	60700	33200
Mercury (Total) - ug/L	<0.20	<0.20	<0.20	<0.20
Nickel (Total) - ug/L	3.6	3.5	6.3	4.8
Potassium - ug/L	7650	8970	7860	7220
Sodium - ug/L	174000	138000	103000	55700
Vanadium - ug/L	<50	<50	<50	<50
Cobalt - ug/L	<10.0	<10.0	<10.0	<10.0
Manganese (Total) - ug/L	439	289	310	1450
Antimony (Total) - ug/L	<1.0	<1.0	<1.0	<1.0
Beryllium (Total) - ug/L	<1.0	<1.0	<1.0	<1.0
Silver (Total) - ug/L	<1.0	<1.0	<1.0	<1.0
Thallium (Total) - ug/L	<1.0	<1.0	<1.0	<1.0
Cadmium (Total) - ug/L	<1.0	<1.0	<1.0	<1.0
Copper (Total) - ug/L	<3.0	<3.0	<3.0	<3.0
Zinc (Total) - ug/L	<10.0	<10.0	<10.0	<10.0
Selenium (Total) - ug/L	<5.0	<5.0	<5.0	<5.0
Arsenic (Total) - ug/L	<5.0	<5.0	<5.0	5.9

⁽¹⁾ Data quality flags are described in Attachment II

Table 6 Field Datalogger Results for the 2001 Little Sandy Creek Water Quality Study

Date m/d/y	Time hh:mm:ss	Temp °C	Specific Conductance µS/cm	DO % Saturation	DO mg/L	pH SU
9/18/2001	11:30:40	18.25	1172	15.8	1.48	7.65
9/18/2001	11:45:40	18.27	1171	15.2	1.43	7.68
9/18/2001	12:00:40	18.28	1172	14.2	1.34	7.67
9/18/2001	12:15:40	18.32	1176	14.2	1.33	7.68
9/18/2001	12:30:40	18.36	1180	13.9	1.3	7.68
9/18/2001	12:45:40	18.41	1182	14.5	1.36	7.68
9/18/2001	13:00:40	18.46	1182	14.6	1.37	7.69
9/18/2001	13:15:40	18.52	1182	14.8	1.38	7.69
9/18/2001	13:30:40	18.57	1185	14.8	1.38	7.69
9/18/2001	13:45:40	18.62	1189	15	1.4	7.69
9/18/2001	14:00:40	18.67	1192	14.6	1.36	7.7
9/18/2001	14:15:40	18.7	1194	14.7	1.37	7.7
9/18/2001	14:30:40	18.76	1198	15.3	1.42	7.7
9/18/2001	14:45:40	18.81	1199	15.8	1.46	7.7
9/18/2001	15:00:40	18.86	1203	15.9	1.47	7.71
9/18/2001	15:15:40	18.92	1203	16.1	1.49	7.71
9/18/2001	15:30:40	18.97	1206	16.2	1.5	7.71
9/18/2001	15:45:40	19.01	1208	16.6	1.53	7.72
9/18/2001	16:00:40	19.07	1210	16.9	1.56	7.72
9/18/2001	16:15:40	19.11	1213	17.2	1.58	7.72
9/18/2001	16:30:40	19.18	1216	17.5	1.61	7.72
9/18/2001	16:45:40	19.21	1221	17.5	1.61	7.73
9/18/2001	17:00:40	19.24	1221	17.8	1.63	7.73
9/18/2001	17:15:40	19.31	1224	18.2	1.67	7.73
9/18/2001	17:30:40	19.34	1229	18.1	1.66	7.74
9/18/2001	17:45:40	19.37	1231	18.2	1.67	7.74
9/18/2001	18:00:40	19.41	1236	18.9	1.73	7.74
9/18/2001	18:15:40	19.42	1238	18.8	1.73	7.74
9/18/2001	18:30:40	19.45	1242	19.7	1.8	7.75
9/18/2001	18:45:40	19.45	1245	20.1	1.84	7.75
9/18/2001	19:00:40	19.45	1246	20.1	1.84	7.75
9/18/2001	19:15:40	19.44	1248	20.1	1.84	7.75
9/18/2001	19:30:40	19.44	1248	20.8	1.91	7.76
9/18/2001	19:45:40	19.46	1251	20.9	1.91	7.76
9/18/2001	20:00:40	19.46	1253	22.1	2.02	7.76
9/18/2001	20:15:40	19.46	1257	22.6	2.07	7.77
9/18/2001	20:30:40	19.44	1256	22.5	2.07	7.77
9/18/2001	20:45:40	19.42	1256	22.6	2.07	7.77
9/18/2001	21:00:40	19.43	1260	23.8	2.18	7.78
9/18/2001	21:15:40	19.43	1262	24.1	2.21	7.78
9/18/2001	21:30:40	19.41	1263	23.7	2.17	7.78
9/18/2001	21:45:40	19.4	1263	23.3	2.14	7.78
9/18/2001	22:00:40	19.4	1264	23.7	2.17	7.78
9/18/2001	22:15:40	19.39	1264	23.5	2.15	7.78
9/18/2001	22:30:40	19.38	1267	24.1	2.21	7.79
9/18/2001	22:45:40	19.37	1269	24.2	2.22	7.79
9/18/2001	23:00:40	19.37	1270	24.4	2.24	7.79
9/18/2001	23:15:40	19.35	1271	23.5	2.16	7.79
9/18/2001	23:30:40	19.33	1272	23.4	2.15	7.78
9/18/2001	23:45:40	19.32	1272	23	2.11	7.78
9/19/2001	0:00:40	19.26	1271	22.4	2.06	7.78
9/19/2001	0:15:40	19.2	1271	21.7	2	7.77
9/19/2001	0:30:40	19.17	1273	21.1	1.94	7.77
9/19/2001	0:45:40	19.17	1275	21.5	1.98	7.78
9/19/2001	1:00:40	19.19	1277	21.7	2	7.78
9/19/2001	1:15:40	19.21	1279	21.9	2.02	7.78
9/19/2001	1:30:40	19.22	1280	22.5	2.07	7.78
9/19/2001	1:45:40	19.22	1280	22.4	2.06	7.78
9/19/2001	2:00:40	19.21	1282	22.2	2.04	7.78
9/19/2001	2:15:40	19.22	1283	22.3	2.06	7.78
9/19/2001	2:30:40	19.24	1285	22.3	2.05	7.79
9/19/2001	2:45:40	19.26	1287	23	2.11	7.79

Date m/d/y	Time hh:mm:ss	Temp ° C	Specific Conductance µS/cm	DO % Saturation	DO mg/L	pH SU
9/19/2001	3:00:40	19.29	1286	23.3	2.14	7.8
9/19/2001	3:15:40	19.31	1287	23.4	2.15	7.8
9/19/2001	3:30:40	19.3	1288	22.7	2.09	7.8
9/19/2001	3:45:40	19.27	1289	22	2.02	7.79
9/19/2001	4:00:40	19.26	1288	21.5	1.98	7.79
9/19/2001	4:15:40	19.26	1289	21.7	1.99	7.79
9/19/2001	4:30:40	19.24	1290	21.2	1.95	7.79
9/19/2001	4:45:40	19.3	1290	23.5	2.16	7.8
9/19/2001	5:00:40	19.29	1289	25.3	2.33	7.81
9/19/2001	5:15:40	19.29	1285	27.6	2.53	7.82
9/19/2001	5:30:40	19.23	1281	27.8	2.56	7.81
9/19/2001	5:45:40	19.18	1276	29.5	2.72	7.81
9/19/2001	6:00:40	19.15	1270	30.7	2.83	7.82
9/19/2001	6:15:40	19.14	1268	32.6	3.01	7.83
9/19/2001	6:30:40	19.15	1271	33.6	3.09	7.83
9/19/2001	6:45:40	19.15	1277	30.8	2.84	7.82
9/19/2001	7:00:40	19.14	1281	29.1	2.69	7.82
9/19/2001	7:15:40	19.14	1283	28.8	2.66	7.82
9/19/2001	7:30:40	19.15	1286	27.5	2.54	7.81
9/19/2001	7:45:40	19.15	1286	28	2.58	7.82
9/19/2001	8:00:40	19.14	1287	26.6	2.46	7.81
9/19/2001	8:15:40	19.11	1287	24.9	2.29	7.8
9/19/2001	8:30:40	19.11	1289	24.2	2.23	7.79
9/19/2001	8:45:40	19.11	1291	24	2.21	7.79
9/19/2001	9:00:40	19.11	1293	24.2	2.23	7.8
9/19/2001	9:15:40	19.12	1293	26.2	2.41	7.81
9/19/2001	9:30:40	19.13	1292	27.1	2.5	7.81



Figure 3 Little Sandy Creek Site OLP090-0007, Facing Downstream

**Little Sandy Creek Dissolved Oxygen Concentrations From Field Datalogger
9/18/2001 to 9/19/2001**

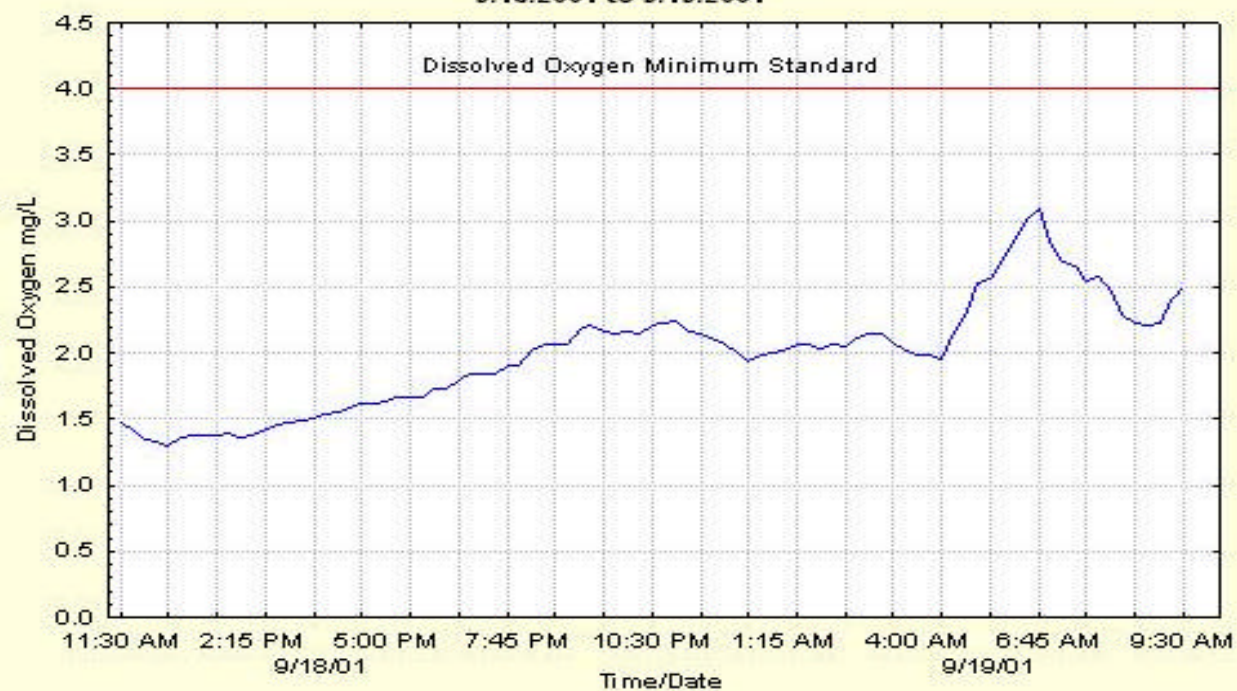


Figure 2 Little Sandy Creek Datalogger Dissolved Oxygen Concentrations



Figure 5 Little Sandy Creek OLP090-0009, Facing Upstream



Figure 4 Little Sandy Creek Site OLP090-0008, Facing Downstream

Quality Assurance/Quality Control

Data Quality

IDEM chemists from the Toxicology and Chemistry Section, Assessment Branch, OWQ reviewed lab data reports from samples for the Little Sandy Creek Source Identification Water Quality Study for compliance to the Surface Water QAPP requirements for Quality Assurance / Quality Control (QA/QC).

Precision

The in-lab quality assurance for data in this report for analytical precision was based on laboratory duplicates, matrix spike duplicates, and Relative Percent Difference (RPD). All the parameters in this data set were within control limits ($\pm 20\%$), except Sulfate and CBOD₅, which were outside acceptable limits, and results were flagged as estimated.

Accuracy

The in-lab analytical accuracy was based on matrix spikes, matrix spike duplicates, quality control samples, and on-going performance recovery samples. The recovery values for Hexavalent Chromium were below acceptable limits and the results were estimated.

Holding Times

Laboratory holding times for all parameters except Hexavalent Chromium were within acceptable limits per Table 2 in 40 CFR part 136. Hexavalent Chromium exceeded acceptable holding times and the results were estimated.

Blanks

Significant results, greater than the MRL, for a parameter indicates contamination from the field sampling process (field blanks) or laboratory sample preparation (field blanks or lab blanks). No contamination was analyzed in the blanks collected for this study.

Of the 148 results gathered for this project, 8.1% (12) were qualified as estimated. As per the Surface Water QAPP, all data collected qualified at Data Quality Assessment Level 3 and is acceptable for use in IDEM decision making processes. Details of the Quality Assurance Analysis are included in Attachment II.

Summary and Conclusions

The results of this Source ID Water Quality Study revealed high levels of sulfate and total dissolved solids in Little Sandy Creek that are believed to be caused by runoff from coal mine areas in the upper reaches of this watershed.

The source(s) of the low dissolved oxygen concentrations are not certain. The datalogger was situated in an area of the stream that was very shaded with very little water depth, and very low stream flow velocities. Dissolved oxygen concentrations, as recorded by the datalogger, did increase slightly on the morning of 9/19 (Figure 5). This rise was probably due to the slight increase of stream flow associated with the approximate 0.25 to 0.5 inches of rain that fell in the

area during the early morning period of 9/19 (Indiana Climate Data). Despite this precipitation, total stream discharge was estimated at less than 0.1 cubic feet second. This reach of Little Sandy Creek had very little stream gradient, resulting in minimal natural stream reaeration. Field observations noted a deep muck substrate with significant amounts of detritus in this reach, which was likely causing some dissolved oxygen depletion. It is important to note that minnows were observed at all sampling locations. No known discharges are located in this reach of Little Sandy Creek and no elevated concentrations of nutrients were found in any of the samples collected in this study or in the three samples collected during the probabilistic sampling in the spring and summer of 2000. Very low stream flow, the lack of natural stream reaeration, and sediment oxygen demand all likely contribute to the low dissolved oxygen levels in Little Sandy Creek.

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Attachment I

Indiana Department of Environmental Management Office of Water Quality/ Assessment Branch/ Biological Studies Section Fish Community Assessments

Site Information

SubBasin: Lower Ohio Little Pigeon 14 digit HUC: 05140201090050 LSite: OLP090-0001
Site: Little Sandy Cr Location: SR 245 County: Spencer
Latitude: 37 59 43.375 Longitude: -86 55 19.117 IASNatRegion: 7C Topo: J-65 Segment: 95
Ecoregion: Interior River Lowland DrainageArea (sq.miles): 6.25 Gradient (ft/mile): 6.52

Sample Information

SampleNumber: AA00530 EventID: 00032 SampleMediumCollected: Water + FishComm + FishTies
SampleDate: 7/11/00 10:55 SurveyCrewChief: SLM SampleTime: 10:55:00 AM HydroLabNumber: 4
WaterFlowType: Pool WaterAppearance: Clear SkyConditions: Partly AirTemperature: 76-85
WindDirection: West (270 degrees) WindStrength: Calm
DissolvedO2 (mg/l): 2.93 pH: 7.63 WaterTemp (°C): 24.1 SpecificConductivity (µS/cm): 1365 Turbidity (NTU): 4.5
SpecialNotes: lots of woody debris, anaerobic substrate

ElectrofishingEquipment: Backpack Voltage: 100 Avg.StreamWidth (m): 2.7 DistanceFished (m): 50
SecondsFished: 1040 WaterDepthAvg (m): 0.4 WaterDepthMax (m): 0.7 TimeAtSite: 2:30
BridgeInReach: ☐ ReachRepresentative: ☒ WhyReachNotRepresentative:
SpecialComments: AA00530, SIREN COLLECTED AND RELEASED (1 AT 18G 227MM)

Habitat Information

TotalScore (max100): 50 SubstrateScore (max20): 4 InstreamCoverScore (max20): 11 ChannelMorphologyScore (max20): 13
RiparianZoneBankErosionScore (max10): 9 Pool/GlideQualityScore (max12): 7 Riffle/RunScoreQuality (max8): 0
GradientScore (max10): 6 %Pool: 80 %Riffle: 0 %Run: 20 %Glide: 0 CanopyCoverPctOpen: 83
SubjectiveRating: 3 AestheticRating: 3 NOTES:

Fish Community Index of Biotic Integrity (IBI) Information

	Actual Observation	Metric Score		Actual Observation	Metric Score
SpeciesCount:	6	3	SensitiveSpeciesCount:		1
Darter/Madtom/SculpinSpeciesCount:	0	0	%TolerantIndividuals:	78.3	1
DarterSpeciesCount:		0	%OmnivoreIndividuals:		1
%LargeRiverIndividuals:		0	%InsectivoreIndividuals:	69.6	1
%HeadwaterIndividuals:		0	%PioneerIndividuals:	21.7	1
SunfishSpeciesCount:	1	1	%CarnivoreIndividuals:	13.0	0
CentrarchidaeSpeciesCount:	2	0	Total #of Individuals(CPUE):	23	1
MinnowSpeciesCount:	1	1	CPUElessGizzardShads:	0	0
SuckerSpeciesCount:	1	1	%SimpleLithophilicInd.:		1
RoundBodySuckerSpeciesCount:	1	0	%Ind.withDeformities,	0.0	1
SalmonidaeSpeciesCount:		0	ErodedFins,Lesions,Tumors:		
Metrics are dependent on Ecoregion and Drainage Area. Metrics can score a 1, 3, or 5 depending on calibration.			TotalIBIScore (min 6=no fish):	14	max=60

Indiana Department of Environmental Management
Office of Water Quality/ Assessment Branch/ Biological Studies Section
Fish Community Assessments

SampleNumber: AA00530 EventID: 00032 LSite: OLP090-0001 County: Spencer
StreamName: Little Sandy Cr LocationDescription: SR 245

Common Name	Individual Fish Count	Deformities	Eroded Fins	Lesions	Tumors	Multiple Anomalies
Bluegill	1	0	0	0	0	0
Creek Chub	4	0	0	0	0	0
Creek Chubsucker	1	0	0	0	0	0
Grazed Pickerel	2	0	0	0	0	0
Spotted Bass	1	0	0	0	0	0
Yellow Bullhead	14	0	0	0	0	0

Attachment II

Quality Assurance of Analytical Data for Water Samples from the 2001 Source ID Study of the Little Sandy Creek GENERAL CHEMISTRIES

Sampling Dates: 09/18/2001

Environmental Toxicology and Chemistry Section, AB/OWQ
QA/QC Review Report: IDEM/100/29/338/094/2001

IDEM Sample Set # 01WQW307

Sample Identification and Sampling Locations

	SampleID	TA Sample No.	Sample Type	Date Sampled	Site Name	River/Stream/Creek/Lake	Sample Location	County
1	AA08586	303095	Normal	09/18/2001	OLP090-0007	Little Sandy Cr	SR 70/245	Spencer
2	AA08587	303096	Field Blank	09/18/2001	BLANK		Dummy Site for Blanks	
3	AA08588	303097	MS/MSD	09/18/2001	OLP090-0008	Little Sandy Cr	CR 700 E	Spencer
4	AA08589	303098	Normal	09/18/2001	OLP090-0009	Little Sandy Cr	CR 700 N	Spencer
5	AA08590	303099	Normal	09/18/2001	OLP090-0010	Little Sandy Cr	CR 625 N	Spencer
6	AA08591	303100	Duplicate	09/18/2001	OLP090-0009	Little Sandy Cr	CR 700 N	Spencer

Notes:

Testing Laboratory:

Test America Incorporated (TA)
Indianapolis Division
6964 Hillside Ct.
Indianapolis, IN 46250

Contact Person:

☐ Ken Busch

☐ Telephone: 317-842-4261

Sample Receipt Date to TA: 9/19/2001

Date Report Prepared: 10/16/2001

TA Job Number (s): 01.04909

Date Report Received: 10/23/2001

Chain of Custody: A check mark [Y] below indicates information about each item is complete and acceptable.

☐ Sampler Signature Y

☐ Custodian Signature Y

☐ Collection Time(s) Y

☐ Collection Date(s) Y

☐ Receiving Time(s) Y

☐ Receiving Date(s) Y

☐ Holding Times Y

☐ Preservatives Y

☐ Containers Y

Part 1. General Chemistries and Metals

A. General Chemistries:

Test Methods and Reporting Limits (mg/L unless otherwise noted)

<u>Parameters:</u>	<u>CAS Number</u>	<u>Test Methods</u>	<u>IDEM</u> <u>Reporting Limits</u>	<u>TA</u> <u>Reporting</u> <u>Limits</u>
Alkalinity	E-14506	310.1	10	10
Chloride	16887-00-6	325.2	1.0	1.0
Chemical Oxygen Demand (COD)	E-10117	410.4	3.0	5.0
Chromium, Hexavalent	18540-29-9	SM3500Cr-D	0.01	0.01
Hardness (as CaCO ₃) by Calculation	E-11778	SM2340B	1.0	1.0
Nitrogen, Ammonia	7664-41-7	350.1	0.01	0.10
Nitrogen, Total Kjeldahl (TKN)	E-10264	351.2	0.05	0.10
Nitrogen, Nitrate+Nitrite	E-10128	353.2	0.01	0.01
Phosphorus, Total	7723-14-0	365.2	0.01	0.03
Solids, Dissolved (TDS)	E-10173	160.1	10	10
Solids, Suspended (TSS)	E-10151	160.2	4.0	4.0
Solids, Total (TS)	E-10151	160.3	1.0	7.0
Sulfate	14808-79-8	375.2	1.0	5.0
Total Organic Carbon (TOC)	E-10195	415.2	1.0	1.0
BOD, 5 Day	E-10106C5	405.1	2.0	2.0

- (1) All 'uJ' flags have been correctly identified in the Data Set reports from TA.
- (2) All 'q' and 'qJ' flags have been identified in the Comments Section of this report.
- (3) All 'b' flags have been correctly identified in the Data Set reports from TA.
- (4) All 'h' flags have been correctly identified in Data Set reports from TA.

Not all flags are applicable to the data set.

Quality Control (QC) Checks and Compliance: A check mark [Y] below indicates information about each QC criterion is complete and acceptable.

- ☐ Summary Data Package Y
- ☐ Prep Dates Y
- ☐ Analysis Dates Y
- ☐ Holding Times Y
- ☐ Approved Analytical Methods Y
- ☐ Approved Detection Limits Y
- ☐ Method, Field, and Trip Blanks (< CRQL or Control Limit) Y
- ☐ Field and Method Duplicates (RPD ≤ 20) Y
- ☐ Matrix Spikes and Matrix Spike Duplicates (± 20%; RPD ≤ 20) Y
- ☐ Instrument Calibrations (Correlation Coefficient ≥ 0.995) Y
- ☐ Laboratory Control Standards (± 20%) Y
- ☐ Initial and Continuing Calibration Verification Standards (± 10%) Y

?

Comments: See Below

IDEM ID	Parameter(s)	Data Flag(s)	Action
AA08586 – AA08591	Sulfate (1)	DJ	Estimated
AA08586 – AA08591	Chromium, Hexavalent (2)	QHJ	Estimated
AA08586 – AA08591	CBOD ₅ (3)	DJ	Estimated

- (1) The RPD between field duplicates was 21.3%. This is outside of acceptable limits. All data for this parameter shall be flagged as estimated. All other quality control indicators are within acceptable limits.
- (2) The samples were delivered to the laboratory outside of the recommended holding time. MS/MSD recovery values are below the acceptable limits. Matrix interference may be suppressing analyte recovery. Concentration values for this sample may be biased low due to the suspected matrix interference.
- (3) The RPD between replicates is above the recommended control range. All data for this parameter shall be flagged as estimated. All other quality control indicators are within acceptable limits. The BOD dilution water blank depletion was between 0.2 and 0.5 mg/L. This is outside of acceptable limits. All results shall be estimated.

B. Metals:

Test Methods and Reporting Limits (ug/L)

<u>Parameters:</u>	<u>CAS Number</u>	<u>Test Methods</u>	<u>IDEM Reporting Limits</u>	<u>TA Reporting Limits</u>
Aluminum	7429-90-5	200.8	4	100
Antimony	7440-36-0	200.8	1	1
Arsenic	7440-38-2	200.8	5	5
Barium	7440-39-3	200.8	2.5	20
Beryllium	7440-41-7	200.8	1	1
Cadmium	7440-43-9	200.8	2	1
Calcium	7440-70-2	200.7	40	1000
Chromium, Total	7440-47-3	200.8	3	2
Cobalt	7440-48-4	200.8	0.5	10
Copper	7440-50-8	200.8	2	3
Lead	7439-92-1	200.8	2	2
Magnesium	7439-95-4	200.7	200	1000
Manganese (Total)	7439-96-5	200.8	0.5	10
Mercury	7439-97-6	245.1	0.2	0.2
Nickel	7440-02-0	200.8	1.5	2
Potassium	7440-09-7	200.7	200	1000
Selenium	7782-49-2	200.8	4	5
Silver	7440-22-4	200.8	0.3	1
Sodium	7440-23-5	200.7	100	1000
Thallium	7440-28-0	200.8	1	1

<u>Parameters:</u>	<u>CAS Number</u>	<u>Test Methods</u>	<u>IDEM Reporting Limits</u>	<u>TA Reporting Limits</u>
Vanadium	7440-62-2	200.7	25	50
Zinc (Total)	7440-66-6	200.8	6	10

- (1) All 'u' flags have been correctly identified in the Data Set reports from TA.
(2) All 'q' and 'qJ' flags have been identified in the Comments Section of this report.
(3) All 'b' flags have been correctly identified in the Data Set reports from TA.
(4) All 'h' flags have been correctly identified in Data Set reports from TA.

Quality Control (QC) Checks and Compliance: A check mark [Y] below indicates information about each QC criterion is complete and acceptable.

- ☐ Summary Data Package Y
☐ Prep Dates Y
☐ Analysis Dates Y
☐ Holding Times (< 6 mo.) Y
☐ Approved Analytical Methods Y
☐ Approved Detection Limits Y
☐ Initial, Continuing, Method, Field, and Trip Blanks (< CRQL or Control Limit) Y
☐ Field Duplicates (RPD \leq 20) Y
☐ Matrix Spikes and Matrix Spike Duplicates (\pm 20%; RPD \leq 20) Y
☐ Instrument Calibrations (Correlation Coefficient \geq 0.995) Y
☐ Laboratory Control Standards, LCS (\pm 20%) Y
☐ Initial and Continuing Calibration Verification Standards (\pm 10%) Y
☐ ICP Serial Dilutions (\pm 10%) Y
☐ ICP Linear Range Studies (\pm 10%) Y
☐ ICP Interelement Correction Factors Y
☐ ICP Interference Check Standard (\pm 20%) Y
☐ ICP CRQL Standard Y
☐ ICP/MS Daily Performance Check Standards (\pm 10%) Y
☐ ICP/MS Stability Check with Tuning Solution (RSD RPD \leq 5% all analytes) Y
☐ ICP/MS Mode: Scanning Mode Y Selection Ion Monitoring Mode

Comments: See Below

<u>IDEM ID</u>	<u>Parameter(s)</u>	<u>Data Flag(s)</u>	<u>Action</u>

Data Qualifiers and Flags for General Chemistries, and Metals

B: This parameter was found in field or lab blank. Whether the result is accepted, estimated, or rejected will be based upon the level of contamination listed below.

- 1) If the result of the sample is greater than the reporting limit but less than five times the blank contamination the result will be rejected.
 - 2) If the result of the sample is between five and ten times the blank contamination the result will be estimated
 - 3) If the result of the sample is less than the reporting limit or greater than ten times the blank contamination the result will be accepted.
- D:** The Relative Present Difference (RPD) for this parameter was above the acceptable control limits. The parameter will be considered estimated or rejected on the basis listed below:
- 1) If the RPD is between the established control limits and two times the established control limits then the sample will be estimated.
 - 2) If the RPD is twice the established control limits then the sample will be rejected.
- H:** The analysis for this parameter was performed out of the holding time. The results will be estimated or rejected on the basis listed below:
- 1) If the analysis was performed between the holding time and 1½ times the holding time the result will be estimated.
 - 2) If the analysis was performed outside the 1½ times the holding time window the result will be rejected.
- U:** The result of the parameter is above the Method Detection Limit (MDL) but below the reporting limit and will be estimated.
- R:** Rejected Results for causes identified
- Q:** One or more of the QC checks or criteria are out of control *or* one or more of the MS/MSD results are outside control limits due to matrix spike recovery problem
- J:** If one or more of the QC checks or criteria are out of control, the results will be estimated. For a parameter, if both the MS and the MSD were outside the 80% to 120% range and were not rerun, a 'J' flag will be used to indicate the results as Estimated values (only the sample used for the spike). However, the following exceptions would apply for not using the "J" Flag.
1. If only one of the Matrix Spikes was outside the % recoveries criteria (80% - 120%) and RPD, but the three QC checks, listed below, for the parameter were within specification, then the result will not be 'J' flagged.
 2. If the RPD was outside the criteria of 0 to 20% and only one or none of the Matrix spike sample was outside the 80% to 120% range, but the three QC checks for the parameters were within specifications as listed below then the result will not be 'J' flagged.

QC Checks for 'J' Flag

1. The Continuing Calibration Standard's recovery was within the (90-110%) range.
2. Contamination was not found above the parameter's reporting limit, and
3. The Laboratory QC Check Standards' recoveries were within the 80% to 120% range.

Data Quality Assessments (DQAs): A check mark (?) below indicates the DQA Level to which the analytical data qualifies.

Level 1 [] **Screening data:** The results are usually generated onsite and have no QC checks. Analytical results, which have no QC checks or no precision or accuracy information or no detection limit calculations, but just numbers, are included in this category. Primarily, onsite data are used for presurveys and for preliminary rapid assessment.

Level 2 [] **Field analysis data:** Data is recorded in the field or laboratory on calibrated or standardized equipment. Field duplicates are measured on a regular periodic basis. Calculations may be done in the field or later at the office. Analytical results, which have limited QC checks, are included in this category. Detection limits and ranges have been set for each analysis. The QC checks information for field or laboratory results is useable for estimating precision, accuracy, and completeness for the project. Data from this category is used independently for rapid assessment and preliminary decisions.

Level 3 [Y] **Laboratory analytical data:** Analytical results include QC check samples for each batch of samples from which precision, accuracy, and completeness can be determined. Detection limits have been determined using 40 CFR Part 136 Appendix B, Revision 1.11. Raw data, chromatograms, spectrograms, and

bench sheets are not included as part of the analytical report, but are maintained by the Contract Laboratory for easy retrieval and review. Data can be elevated from level 3 to level 4 by the inclusion of this information in the report. In addition, level 4 QC data must be reported using CLP forms or CLP format. Data falling under this category is considered as complete and is used for regulatory decisions..

Level 4 ☐ **Enforcement data:** *Analytical results mostly meet the USEPA required Contract Laboratory Program (CLP) data analysis, contract required quantification limits (CRQL), and validation procedures.* QC data is reported on CLP forms or CLP format. Raw data, chromatograms, spectrograms, and bench sheets are included as part of the analytical report. Additionally, all reporting information required in the IDEM/BAA and in the Surface Water QAPP Table 11-1 are included. Data is legally quantitative in value, and is used for regulatory decisions.

Compliance Statement:

The laboratory results for a Data package from **6 water** samples received from Test America (TA) were reviewed for compliance with IDEM BAA 97-44, dated 4/18/97 and OWM QAPP (Rev. 2, June 1999) for Indiana Surface Water Programs.

Summary and Conclusions:

- | | |
|-----------------------------------|------|
| 1. Data Quality Assessment Level: | 3 |
| 2. Level of Completeness: | 100% |

The data for the **6 water** samples from data package **01WQW307** has been assigned to Data Quality Assessment (DQA) Level 3 of QAPP for Indiana Surface Water Programs. The analytical results for **6 water** samples appear acceptable and could be used for OWM decision making.

Reviewed by:

Signature: Tim Bowren Title: Chemist Date: October 23, 2001

Signed Copy on File

Approved by:

Signature: Dr. Syed GhiasUddin Title: QA/Coordinator Date: _____

Signed Copy on File

Distribution List:

Larry McFall
Tim Bowren

(File copy)
Dr. GhiasUddin